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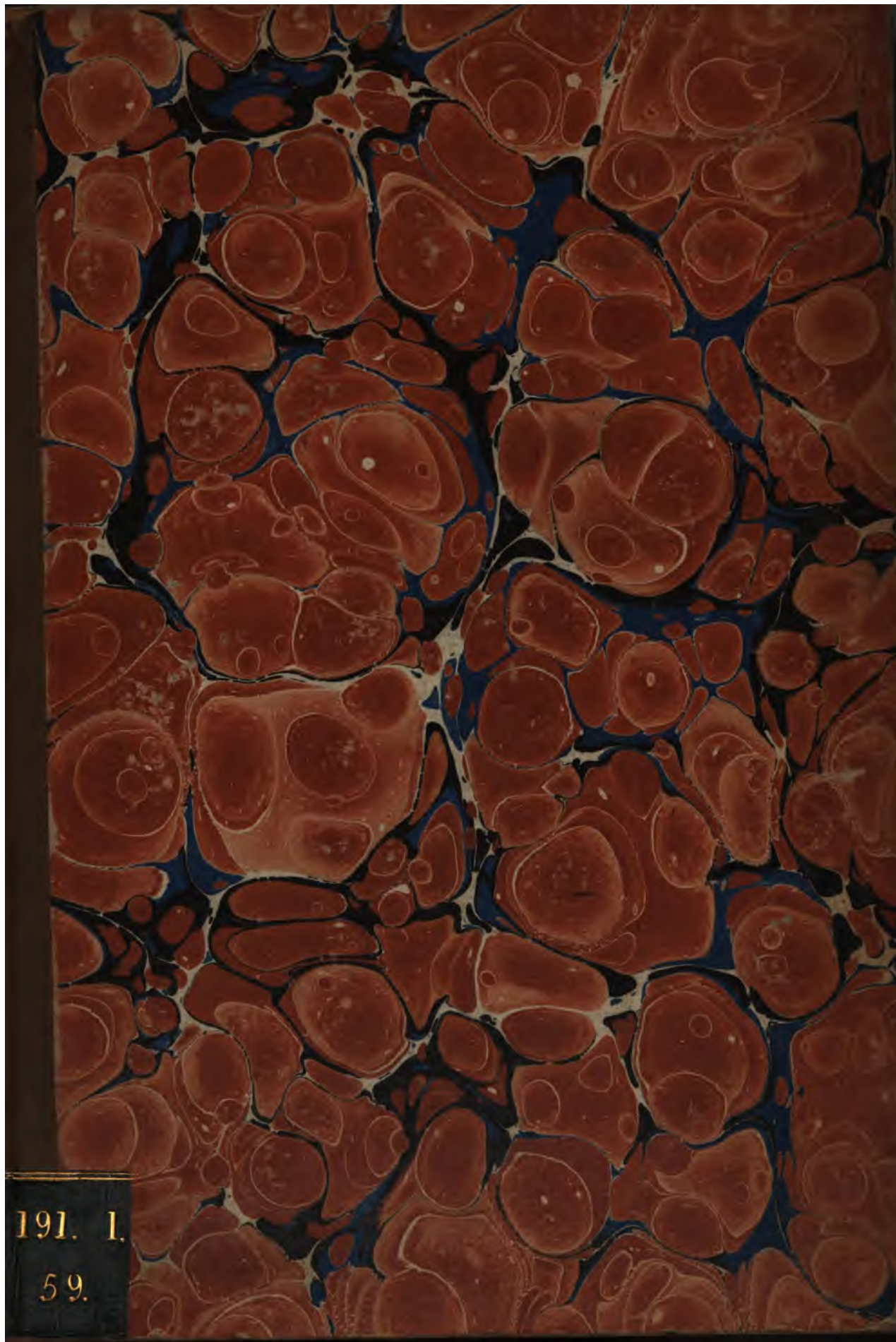
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ON THE  
HISTORY, CULTIVATION, COMPOSITION,  
AND  
FEEDING PROPERTIES  
OF  
MANGOLD WURZEL.

BY  
JOHN TYNAN,  
A PUPIL OF THE ALBERT NATIONAL AGRICULTURAL INSTITUTION.

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"WORK AND LEARN."

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DUBLIN:  
THOMAS H. SAUNDERS, 31, LOWER SACKVILLE STREET.  
1858.

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## NOTICE.

THE annexed extracts from "The Journal of the Chemico-Agricultural Society of Ulster," (No. 12, New Series) fully explain the circumstances which induced me to attempt writing on the Cultivation, &c., of Mangold Wurzel.

JOHN TYNAN.

ALBERT NATIONAL AGRICULTURAL INSTITUTION, GLASNEVIN,  
Dublin, 1st March, 1858.

### CHEMICO-AGRICULTURAL SOCIETY OF ULSTER.

#### COUNCIL MEETING.

JANUARY 1.—John Andrews, Esq., J.P., High Sheriff of Down, and afterwards William Sharman Crawford, Esq., D.L., Vice-President, occupied the chair. There were also present—Rev. George Smyth, Carnmoney; Professor Hodges, chemist to the society; Professor Thomson, C.E., Queen's College; Dr. Hamilton, Belfast; W. B. Ritchie, Hon. Secretary; Robert Shaw, Ballymechan; Geo. C. Hyndman, Belfast; Oliver Devlin, Ulster Model Farm."

#### PRIZE ESSAY ON THE CULTIVATION OF MANGOLD WURZEL.

Dr. HODGES read the following letter, which he had received from Dr. Kirkpatrick, Head-Inspector of Agricultural Schools, in reference to a copy of a prize essay which he forwarded, and which was directed to be published in *The Journal*:—

"Albert Institution, Glasnevin, Dublin,  
29th December, 1857.

"MY DEAR DOCTOR,—A distinguished American agriculturist, who visited the Albert Institution and Farm in autumn last, was so greatly pleased with the mangold wurzel crop that he begged I would favour him with full particulars relating to it, the preparation of the land, the manures applied, and the after-management of the crop. It struck me that the making out of such a statement as he expressed a wish to have, would be a useful exercise for the pupils, and at the same time test the agricultural knowledge which they had attained, and show their capabilities of composition, &c. I accordingly offered one or two prizes for the best written essay on the history, cultivation, &c., of mangold wurzel, and shortly afterwards received about twenty essays. As it was most desirable that the merits of the several essays should be decided upon by a person not only competent to form an accurate opinion, but who was also unacquainted with any one of the writers, I submitted them to my friend, John Fisher Murray, Esq., who most kindly and obligingly gave them a minute and careful examination, and I now annex the following gratifying extracts from a letter which I have just received from him:—

"John Tynan's essay is the best, reads most fluently, while containing all the information of any of the others; the paper of Wm. Birnie deserves honourable mention for fluency of style; that of Patrick Cooke for the minuteness and precision of

the details; and that of George Elwood for the neatness of penmanship, besides a fair store of the merits ascribed to the former ones.

"It is a very close run; the competitors tread upon the heels of each other; the winners come in at no very great distance before the rest.

"All the essays are creditable; not many years ago it would not have been credited that so many productions, respectable alike in matter, arrangement, and style, could have emanated from young men accustomed to labour with their hands.

"The young men, the institution, and the public at large may congratulate themselves and each other upon the prospect opened to society by such productions as the essays in question."

"I herewith send you Tynan's Prize Essay, which, I think, should be published, as it contains a large amount of valuable and useful information on the cultivation, &c., &c., of a green crop, which, in my opinion, merits greater attention than it has hitherto received from the agricultural community.

"I shall not distribute the prizes amongst the successful competitors until you come to us, which, I hope, you will be able to do in the early part of next week.—I am, dear Doctor, yours faithfully,

"THOMAS KIRKPATRICK.

"Professor Hodges, &c., &c., Belfast."

Dr. HODGES having read the prize essay referred to in Dr. Kirkpatrick's letter,

JOHN ANDREWS, Esq., said that he had had many opportunities of observing young men who had received their education at the Agricultural Schools of the National Board, and also at the Templemoyle School, and he considered that the training which was given to the pupils in these institutions was of the most useful kind, and of great importance to the country. He thought that they should thank both Dr. Kirkpatrick for the essay forwarded, and also express their opinion of the value of Agricultural Schools in the present circumstances of the country.

Dr. Hodges, Professor Thomson, and the Chairman, having expressed opinions in accordance with the views of the High Sheriff, the following resolutions, on the motion of Mr. ANDREWS, seconded by PROFESSOR THOMSON, were unanimously adopted by the meeting.

It was resolved—"That the thanks of this Society be given to Dr. Kirkpatrick, for his attention in communicating this essay, and that he be informed that for the purpose of giving it extended circulation, it shall be printed in the Journal of this Society."

"Resolved.—'That this Society cannot fail to recognise the important advantages conferred on the Agricultural community by the Albert Institution in the education of young men, who are destined to conduct and direct the practice of Agriculture in Ireland, of which the essay now before us, being one of twenty, and all of which have received commendation from the judge to whom they were submitted, is a striking proof.'

"Resolved.—'That this Society desires to express

its anxious hope and expectation, that a of economic science will not be perm Government of this country to interri gress of Agricultural instruction at the tution, and the local establishments u of the Commissioners of Education, v yet unimproved and backward state c Agriculture in Ireland, is so well calcu tribute to the promotion of national pro

## ESSAY.

*History of the Plant.*—Mangold Wurzel, or, as it is often called, "Mangel Wurzel," which signifies "root of scarcity," has been, like all our cultivated green crops, obtained by culture from the original wild species.

Botanically considered, the Mangold Wurzel (*Beta Vulgaris Campestris*), or, as it is sometimes called, "field beet," is a species belonging to the genus *Beta*, which is contained in the class *Pentandria* and order *Digynia* of the Linnean system of classification, and in the order *Chenopodea* of the natural system.

It was introduced into Great Britain from the Continent of Europe at no very remote period; but the precise time, is not easily ascertained, as a considerable diversity of opinion exists amongst authors on this point; probably it was the year 1773, as would appear from the following extract, taken from *The Penny Cyclopædia of the Society for the Diffusion of Useful Knowledge*:—"The common field-beet for cattle, which has been long known in Germany, was introduced into England at the latter end of the last century," to which it may be proper to add, "and its introduction is generally attributed to the late Dr. Letsom, a physician of great reputation, and one of the Society of Friends." At its first introduction it was grown only by a few enterprising gentlemen, but it gradually extended, and subsequently found its way into this country, where it was, (like the potato at its first introduction), for a long time looked on as a curiosity, rather than cultivated as a useful auxiliary to cattle feeding. At length the success which attended its cultivation by a few individuals who ventured to give it a trial, induced others to follow their example, and it thus gradually, but steadily, progressed, till, at the present day, it holds such a place in the green cropping of this country as no longer to deserve the title of *root of scarcity*; but, at the same time, is not yet cultivated to such an extent as its merits seem to entitle it.

*Climate and Soil.*—It is capable of accommodating itself to a great range of climate, flourishing in Europe, between the parallels of 46° and 56° north latitude (if the situation be not too bleak or exposed), fair crops having been raised in the latter latitude in Scotland; but the climate which is considered to be best suited to it is that of the south of England, where frosts do not set in early, and which has a high summer temperature. In this country, where the summers are not so warm as in England, though enjoying a mild and genial climate, with a more moist and humid atmosphere, large crops have been obtained. "Local climate," says Professor Johnston, "modifies very much the relative quantities of the same crops obtained in different localities. Thus,

in the Southern part of Wigtownshire, 30 to 20 tons of Mangold, and 20 tons of White acre, are equivalent crops, while in Berkshire easy to grow 30 tons of Mangold as 20 to per acre."—*Elements of Agricultural* 341.

It likewise adapts itself to a great variety, having been grown in this country on descriptions of land, yielding remuneration on light soils, provided they be not too gravelly, and on clays that are not of too close texture; it will, however, yield fair crops stiff for turnips; but it attains its greatest and yields its maximum produce only in friable loam, in good condition, and with a considerable quantity of vegetable matter, with a sound, dry subsoil, and in a situation not too exposed. It also yields very heavy crops on reclaimed bog-land, rendered sound and fertile by manure.

"It is suited," says Mr. Bond, "to our soil. It will grow as well on the stiff soils as on the light. It is peculiarly a heavy land root; its roots are suited to the retentive soil, as it can be hard in the wet season sets in, and its keep renders it invaluable, especially on our soil, on cause of the lateness of the growth of food in spring."—*Farmer's Magazine*.

*Varieties as Adapted to the Different Soils.*—All our cultivated crops, many varieties of Mangold Wurzel have been obtained by different processes in connexion with the soil, and which, if not produce often be effected by nature. Though many varieties produced in this way, only a few, comparatively speaking, are cultivated, the principal being the Long Red and Long Orange, and the Orange, Yellow, and Globes. Where the land is deep and heavy, and peaty character, the long varieties are preferred; but when of a lighter texture, the Globes are preferred.

Having now described the properties of the Long and Globe varieties when considered in relation to the soil, the question would naturally suggest itself to the reader—What are the comparative properties of the respective varieties of each sort, as, for example, the Long Red, Yellow, and Orange Globes? This is a question very often asked, but it is one to which no accurate answer can be given, as there are too many circumstances, such as the nature of the soil, the produce of the Red exceeds that of the others, and so of the Yellow and Orange Globes. These variations must be attributed to many circumstances, such as changes in the soil, climate, manures, &c., which

stances, cannot be defined. The Orange variety, however, appears to yield the best crops, and adapts itself to the greatest range of soils.\* The same observations may be made with respect to the long varieties, amongst which the Red holds the same position as the Orange amongst the Globe varieties. The Silesian, or Sugar Beet, is another variety, but as its produce is generally much inferior to any of the other sorts, it is scarcely ever cultivated as a direct food for cattle. On the Continent of Europe it is, in some places—as, for instance, France—grown largely for the manufacture of sugar.

With these preliminary observations, nothing now remains but to enter upon its cultivation, and the first subject which presents itself for consideration is the

*Preparation of the Soil.*—Being a green crop, its place in most rotations is after a corn crop. Assuming, then, that the land is in stubble, in autumn, and either thorough-drained or naturally dry, it is to be treated in precisely the same manner as if preparing for any other green crop. The land, whether autumn cleaning is carried out or not (if it be, so much the better), is to receive a deep ploughing in autumn or early winter. As this crop, of all others, requires deep culture, if the field intended for it has not been recently subsoiled, and the soil and subsoil suited for this operation, it should be performed now, the subsoil plough following in the track of the common plough, and in this way the land is thrown over with a good rough furrow, leaving a large surface to the ameliorating influence of the winter weather. It is a common practice with many farmers to plough in the farm yard-manures intended for the crop, at this season; and if the land be well suited for autumn manuring, it will not only materially forward the spring work, but also the constituents of the manure will be in a very available state at the time the young crop requires them, besides being intimately incorporated with the soil by the subsequent operations performed on it. The land having been ploughed up in a rough state in autumn, or early winter, as before mentioned, may be allowed to remain so till the following spring, when it should receive a harrowing to destroy any seedling weeds that may be springing up. When the sowing season approaches, the land should be cross-ploughed, harrowed, and rolled, and afterwards repeatedly grubbed, harrowed, and rolled till it be reduced to a fine state of tilth. After each harrowing, all weeds should be carefully collected and removed, and the proper cleaning of the ground, previous to the sowing of all kinds of green crops, cannot be too strongly inculcated. The number of ploughings, grubblings, &c., necessary to be given in order to obtain the required degree of pulverization, depends on the nature of the soil and its previous treatment; where the soil is naturally loose and friable, a single ploughing, with one or two operations of the two-horse grubber, will suffice; but where it is of a more tenacious character, the labour will proportionately increase. When the desired degree of pulverization has been effected, it is to be finally rolled and drilled.

In those districts where the climate is very dry, and the soil also dry and light, and liable to become destitute of a sufficiency of moisture for the growth of the young crop during the summer months, green

crops are usually grown on the "flat;" but in this, or any other country possessing a humid atmosphere, and consequently little danger of the above results, the raised-drill system is to be recommended, and is almost universally adopted.

The land being prepared as above described, drills should be opened, twenty-seven to thirty inches apart, with the double mould board plough, or, if it be not at hand, the common plough must be used. If the manure had not been applied in autumn, it should at least have been carted out during the winter months to some convenient place closely adjoining the field intended for the crop, in order to facilitate the application of it now. When the drills are opened the manure should be immediately deposited in quantity proportionate to the requirements of the land, all lumps well broken and divided, and evenly spread in the bottom of the drills, and at once covered in, and the seed sown. No more drills should be opened at a time than can be manured, covered in, and sown on the same day; for, by an adherence to this principle, a great portion of the fertilizing ingredients of the manure is preserved from loss by exposure to the atmosphere, and the seed being sown in the fresh earth, germination is materially assisted, circumstances on which the secret of successful cultivation in a great measure depends.

*Manure.*—Of all the manures employed in the production of any crop, farm-yard manure may be considered the staple, but particularly so for the Mangold, of which large crops are raised by its aid alone; good crops have been also grown, where the soil is naturally rich, by the application of guano, vitriolized bones, and other artificial or special manures, or, where a sufficiency of farm yard manure is not to be had, the deficiency may be made up by the use of extraneous manures, and in such proportion as circumstances may require.\*

The farm-yard manure, whether alone or in conjunction, should be very well decomposed, and well mixed by turning, before its application in spring. The quantity applied should be commensurate with the requirements of the soil; but to land of average fertility, 25 tons per statute acre, when applied alone, would be sufficient. If extraneous manures be used alone, 5 cwt. of guano, or 7 cwt. of vitriolized bones, would be a fair application; it is not advisable, however, to raise Mangolds with these manures alone, where farm-yard manure can conveniently be obtained, unless the soil be very rich. A dressing of common salt is highly beneficial to this crop; whether it produces its effects by acting directly on the crop, or indirectly by rendering available some constituents of the manure or soil, or whether they may be attributed to both, is not well known, but it has been ascertained, by chemical analysis, that the ash of both tops and bulbs contains a large amount of common salt.† The quantity of common salt contained in the Mangold is so large as to be quite perceptible to the taste in the growing plant, especially the leaf; the amount of sugar contained in the bulb counteracts the taste of the salt in it. Though a moderate application of common salt is found to

\* On light chalky soils, a mixture of guano, nitrate of soda, and common salt, at the rate of 2 cwt. each per acre, has been found very efficacious in the growth of Mangold Wurzel.—*Nesbit's Agricultural Chemistry*, p. 100.

† "Mr. Austen, of Chitworth, near Guilford, who farms on the green sand, has informed me, that with common salt alone on his land, he has succeeded in growing an excellent crop of Mangold Wurzel, by applying it after the plant was up in successive doses of 2 cwt. per acre up to 6 or 8 cwt. Every fresh application appeared to give the crop a new start."—*Johnston's Experimental Agriculture*, p. 63.

\* On this (the Albert Model Farm), where the soil is a rich loam, containing a large amount of organic matter (over 14 per cent.), and which is well suited to the growth of Mangolds, carefully conducted experiments for several years past, have shown that the Orange Globe invariably yields the largest and best crops.

increase the produce, yet too large an application is not attended with similar beneficial results, as appears from experiments made on this farm\* during the present year, for the purpose of ascertaining the efficacy of common salt on the Mangold crop, in both large and moderate quantities. The following table is quite sufficient to illustrate this. All the circumstances connected with the cultivation were precisely similar, except in the case of the salt applied.

Variety of Mangold Wurzel.	Quantity of Manure per Statute Acre.		Produce per Statute Acre of Bulbs.	
	Farm-Yard Manure.	Common Salt.		
	Tons.	Cwt.	Tons.	Cwts.
Orange Globe	18	—	30	10
Do. Do.	18	7	32	6
Do. Do.	18	14	31	17

The best mode of applying the salt is to scatter it over the manure when spread in the bottom of the drill, and by this means there is no danger of its coming into contact with the seed, the vitality of

which it would otherwise destroy. W of the extraneous manures are used yard dung, they may be applied in the or spread along at the back of the fir plough when the drill is being formed in by the second bout, which comple By this latter mode it will be nearer plant when the seed has vegetated, will be sooner available. There are of applying them, but in all cases care that they do not come into contact with the salt, they have all a tendency vitality.

In the summer of 1856, Mr. Caird, interesting series of experiments careful on his farm in Kent, with the view of "the kind of manure which, at the produce the greatest effect" on the Mangold crop.

The following table gives the quantities of the different manures, the produce &c. :—

No. of Lots.	Kind and Quantity of Manure per Acre.	Cost per Cubic Yard or Cwt.	Total Cost of Manure per Acre.	Produce
			£ s. d.	Tons.
1	20 Cubic Yards of Dung,.....	3s. 6d. per yard.	5 18 0	
	4 Cwt. Guano, .....	12s. 0d. per cwt.		
2	20 Cubic Yards of Dung,.....	3s. 6d. per yard.	6 5 6	
	4 Cwt. Guano, .....	12s. 0d. per cwt.		
	5 Cwt. Salt,.....	1s. 6d. " "	4 18 6	
	20 Cubic Yards of Dung,.....	3s. 6d. per yard.		
3	1 Cwt. Guano, .....	12s. 0d. per cwt.	7 0 0	
	1 Cwt. Superphosphate, .....	7s. 0d. " "		
	1 Cwt. Nitrophosphate,.....	6s. 6d. " "	2 14 0	
	2 Cwt. Salt,.....	1s. 6d. " "		
4	40 Cubic Yards of Dung,.....	3s. 6d. per yard.	4 10 0	
	2 Cwt. Guano, .....	12s. 0d. per cwt.		
5	2 Cwt. Superphosphate, .....	7s. 0d. " "	4 4 0	
	2 Cwt. Nitrophosphate,.....	6s. 6d. " "		
	2 Cwt. Salt,.....	1s. 6d. " "	3 18 0	
6	7½ Cwt. Guano, .....	12s. 0d. " "		
7	12 Cwt. Superphosphate,.....	7s. 0d. " "	1 16 0	
8	12 Cwt. Nitrophosphate, .....	6s. 6d. " "		
	1½ Cwt. Guano,.....	12s. 0d. " "	3 0 0	
	1½ Cwt. Superphosphate,.....	7s. 0d. " "		
	1½ Cwt. Nitrophosphate, .....	6s. 6d. " "	2 16 0	
	1½ Cwt. Salt, .....	1s. 6d. " "		
10	5 Cwt. Guano, .....	12s. 0d. " "	2 12 0	
11	8 Cwt. Superphosphate, .....	7s. 0d. " "		
12	8 Cwt. Nitrophosphate,.....	6s. 6d. " "		

Each lot occupied the tenth part of an acre—each containing three rows of roots—the middle was weighed in testing the results. "It will be seen that in every instance where salt forms of the manure the produce is increased."

**Time and Mode of Sowing.**—The season for sowing the Mangold Wurzel, in this climate, extends from the middle of April to the middle of May; but the last week in April is considered the best time. If sown too early, the liability of the plants to start to seed during growth, the greatest evil attending their cultivation, is increased; if too late, the crop remains in a backward

\* I may be permitted to remark, that the various experiments conducted on the Albert Farm are very correct and perfectly reliable, as great care and attention are exercised in carrying them out; besides, being generally conducted on a pretty large scale, and the entire produce weighed, there is no danger of those errors which so frequently occur from the present system so generally adopted for ascertaining the acreable produce.

state during the growing season, and its full perfection, especially if dry weather immediately after sowing.

Mr. Miles, M.P., in a paper on the "Mangold Wurzel," in Vol. II. of the *Royal Agricultural Society of England*, earlier in April your Mangold Wurzel better; the deeper the tilth the greater of a heavy crop." And a recent writer in *journal* (Mr. Paget, of Ruddington Nottingham,) states:—"The best seed locality is, in my opinion, from April 7th It is useless, in general, to sow it earlier temperature is, I think, too low for the

of the seed. My experiments do not lead me to believe that this comparatively early sowing produces many 'runners,' and our Summers are too short to admit of unnecessary delay in sowing."—(Vol. XIII. p. 405.)

When, however, through any cause the seed cannot be got in at the proper time, by steeping it in sand or earth moistened with water, or in dilute liquid manure for three or four days, germination will be so far promoted that it will be equivalent to having it, at least, the same time sown. Indeed, many persons recommend the steeping of the seed in all cases, but it is not always safe to do so, for should dry weather occur after sowing, the germination thus artificially produced receives a check which often proves fatal or injurious.

The drills being opened, the manure spread and covered by splitting the drills with the double mould-board plough, the drills thus formed should have their tops slightly levelled by a very light roller, and the seed sown either in a continuous line along the crown of the drills, or deposited in tufts or bunches at the distance apart which the plants are intended to be left at the time of thinning. Owing to the peculiar construction of the pericarp, in which the true seeds are contained, no sowing machine has hitherto been generally employed. If, however, an efficient machine be available, it is, by all means, to be recommended; but in the absence of such, the hand and common hand-hoe, or dibble, are efficient, though rather slow substitutes. Under these circumstances, the method most commonly practised, and which is most to be recommended, is with the hand-hoe to open holes at the required distance apart, and from an inch and a-half to two inches in depth; another person follows and drops three or four capsules (or, as they are commonly called, seeds) in each hole, followed by a third, who, with a spade, shovel, rake, or any other convenient implement, draws a sufficiency of mould over the seeds to cover them to a depth proportionate to the texture of the soil, the average being about an inch and a-half; but if the soil be of a light nature, and the weather dry, two inches would not be too deep. By this mode of sowing, three careful boys, women, or girls, would sow at least an acre in a day. About 6lbs. of seed per statute acre is the quantity usually sown, which, if not saved on the farm, should be procured from a respectable and trustworthy seed merchant, in order to ensure what is genuine, as great losses are often sustained by farmers from purchasing cheap but bad seed.

In forming holes for the seed, the dibble is sometimes employed, which makes from four to six holes at a time by a single pressure of the foot, and is much more expeditious than the hoe; but it has been objected to for two reasons; the first and more important is, that the holes are too small, and the seeds, when put in, fall together, and consequently grow up intertwined with each other, which is very injurious to their early growth, and troublesome at the time of thinning; the other is, that the soil immediately about the seed is consolidated, instead of having that loose texture which is so essential for promoting the growth of the minute and tender roots. These objections may, in a great part, be obviated when the teeth of the dibble are made pretty large and the soil light and friable. In sowing the seed, it is well to bear in mind what has been previously said when treating of the varieties as suited to the various classes of soils. In addition to this, it may not be out of place to insert here a table of the produce yielded by the different varieties grown this year on this farm, though, at the same time, similar results are not to be expected in all climates or classes of soils. The de-

scription of soil has been alluded to in a note at a preceding part of this essay; the manuring and all things else connected with the cultivation were, in each case, the same, and the following are the results:—

Variety of Mangold Wurzel.	Produce per statute acre	
	Tons.	Cwts.
Orange Globe,.....	32	6
Deep Orange Globe,.....	29	18
Long Red,.....	28	15
Long Yellow,.....	28	14
Red Globe,.....	26	14
Sugar Beet,.....	30	12

It is surprising to observe the extraordinary produce of the Sugar Beet, being superior to most of the varieties of Mangold, while in ordinary cases it averages about three-fourths the produce of the Mangold, or about 18 tons per acre.

*After Culture.*—Like the turnip, the after culture of the Mangold Wurzel may be said to consist in *timely and careful thinning, attentive weeding, and keeping the soil in a loose and friable state by means of the drill grubber, drill-harrow, and hand-hoe.* But, to be more particular, the young seedling plants will appear above ground in about ten days after sowing, —sooner or later, as circumstances are favourable or otherwise; and when sufficiently advanced, the drill-grubber, or, where the land is tolerably loose, the drill-harrow, should be run between the drills to destroy whatever weeds may be growing, and at the same time to assist in tilling the soil. When the plants show a pretty strong leaf, and before there is any danger of injury from allowing them to grow up too strongly, thinning and weeding should commence. If the seed had been sown in a continuous line by machine or otherwise, this operation may be performed by the hand-hoe, taking care to allow the strongest and healthiest plant to remain. The distance apart at which the plants are to be left is determined by the size they are expected to attain. Where the soil is rich and everything favourable to their growth, the greatest space is allowed. When the seed was sown in tufts or bunches, the hand must necessarily be used in thinning, and the distance determined at the time of sowing; from twelve to sixteen inches are usually allowed. In thinning, the plants must not be completely singled out at the first operation; it is better to allow two of the healthiest and strongest to remain together, and at the final thinning, which takes place in about a month afterwards, the more promising plant should be left. This plan is most necessary to be adopted to prevent the losses which otherwise are likely to happen, by many of the plants starting to seed, and which is materially checked by having the one which presents symptoms of seeding\* pulled, and the other left to grow.

As the thinning proceeds, any blanks that may occur should be filled up by transplanting; this is the only case in which the transplanting of Mangolds is to be recommended; and even then, unless the weather be favourable and the operation very carefully performed, the result will not be very successful. Moist weather is the most suitable for this purpose, and the best way to proceed is to open a hole with the spade, where the blank occurs, large enough to receive the whole tuft of plants, with as much clay as can be raised about them. When de-

\* The principal symptoms indicative of a plant likely to run to seed are—The heart of the tuft of leaves appears high and forward, thus evincing a tendency to produce a seed stalk; there is also an absence of that healthy succulency observable in a better-disposed plant.

posited in the hole, the clump must be carefully firmed, and all the plants then drawn out, except the one intended to be left. This method of transplanting cannot be practised with the thinnings of the crop, as the entire bunch must be used; therefore, at the time of sowing, it is necessary to sow a small plot in some convenient place for the special purpose of transplanting, and by observing the above conditions a fair return may be expected.

When weeds are again beginning to appear, after the first thinning and weeding, the crop should be hand-hoed, and again grubbed and drill-harrowed. In hoeing great care must be taken that none of the plants be disturbed or in the least degree injured, as the slightest wound inflicted on them in the young state increases during growth, producing a kind of canker in the part, which not only presents a very unsightly appearance, but also greatly injures the value of the bulb, no other of our green crops being so susceptible of injury. In drill-grubbing and harrowing there exists no danger of injury, provided the implements be properly adjusted and carefully employed; but in all the operations great care must be exercised.

Another hand-hoeing and drill-grubbing should be given some time before the crop is so far advanced as to render it unsafe to work amongst it.

In conducting the after culture of the crop, it is well to keep in mind that the number of operations need not be restricted to those above-mentioned, for when the soil is a strong one *more* will be required to keep it in a loose state, to admit of the passage of the minute spongioses and delicate fibres in search of food; but on average soils those enumerated are sufficient.

Regarding the propriety of divesting the plants of a portion of their leaves, so much practised in many places, and which yields such a large supply of valuable feeding at a time when other green food is scarce, different opinions are entertained ; but there is no disputing the fact that if they be removed too early, while in a succulent and active state, the produce of the growing crop will be diminished, which will appear to be an evident and unavoidable result when we reflect on the important functions performed by the leaves of plants. On the other hand, if the leaves be not removed till they are observed to droop or flag, showing by their appearance that they are no longer actively employed in performing their special and valuable functions, then they may be removed with safety. The first removal of the leaves may commence towards the middle of September, when those exhibiting the above appearances should be collected, and a fresh supply for a second gathering will be ready towards the middle of October. By this means a large quantity of excellent cattle feeding may be obtained, which would otherwise be either lost or come in at a period when it would not be of half its value, other feeding being then plenty. The value of Mangold leaves as a food for milch cows stands high amongst green fodder, as tested by a series of carefully-conducted experiments made at this (the Albert) Institution, of which the following table shows the results :—

The mangold leaves are very much liked by milch cattle, and from six to eight stone of the leaves, alternately with hay or straw, is a good feed for an ordinary sized beast.

“The leaves of the plant,” remarks son, “also appear to possess a far big as a *feeding* and as a *manuring* substances are accustomed to assign to them. (Annales de Chimie) gives us an organ the roots and the leaves, of the plants between their respective composition much in favour of the leaves for the mentioned. The substances were determined previous to their analysis. Their water were about the same, and the composition was as follows:—

	Root.
Carbon, .. .. .	42.75
Hydrogen, .. .. .	5.77
Oxygen, .. .. .	43.58
Nitrogen, .. .. .	1.66
Ash, .. .. .	6.24

thus showing that, in a chemical point of view, leaves were three times as valuable as roots would be."—*Journal of the Royal Society of England*, Vol. XIII. p. 100.

*Storing.*—About the beginning of crop will have arrived at maturity, and should be lost in getting it into the should frost occur, the bulbs are liable severely. The opportunity of dry weather possible, be seized upon for this purpose occur in the end of October, for if weather this can be done without injury whilst the crop will thus be taken up for securing its safe keeping, even to the following season. Having selected place for storing the bulbs, the operation, carting, &c., should commence with all possible despatch. The bulbs every four drills should be placed in hollow space between the two middles this means the carts can pass between be filled from both at the same time be thrown in heaps also, in such a manner interfere with the carting. In topping the leaves, a sharp knife or sickle but the utmost caution must be taken be not severed so close to the bulb as should it happen to be cut, the juices through the wound, and not only its nutritive properties thus lost, but liable to decay. To avoid this danger have the tops twisted off with the hands forms the work very expeditiously. be pulled and topped in the field then in and stored the same day, for should over night the denuded bulbs will while if standing and protected by their its effects will be greatly lessened. ably happen to be left out, they may making into heaps and covering them Should any, however, be frozen, by posture, they should be kept separate as soon as possible, as they will a length of time.

In selecting a place for storing, northern aspect and dry situation be better can be desired than to store it neatly, making the heap about six base, and sloping up against the wall six or seven feet. When this method

No.	Date of Experiment.	Kind of Feeding.	Butter produced by 40 quarts of milk.	
	1857.		Lbs.	Ozs.
1	4th May.	Italian Rye Grass alone . . .	3	5
2	5th Sept.	Italian Rye Grass & Pasture	3	13
3	28th Sept.	Mangold Leaves and Pasture	3	14
4	6th Oct.	<i>Mangold Leaves alone</i> . . . . .	4	

convenient, the bulbs may be built into roof-shaped heaps, about six feet in width at the base, and five feet in height, in a dry place. Another very good way to store them, is to build two dry stone walls, parallel to each other, sufficiently distant to allow a cart to pass between them, about four feet high, and of any required length. Hurdles may be substituted for stone walls, and enclosures made by brush-wood, &c., when found more convenient. Into these enclosed spaces the bulbs are put and piled up, terminating in a ridge. This latter method of storing is a good means of economising space; and if it be adopted, the dry stone walls, (if hurdles, &c., be not used in their stead), require to be plastered or dashed with mortar, to prevent frost from entering the crevices. Whatever mode of storing is adopted, the same great object is to be kept in view, viz.—the safety of the crop by preserving it from frost and wet, by carefully thatching as quickly as the heap is made, and making provision for the removal of all wetness caused by rain or otherwise. Being carefully stored, thatched, and kept dry, the mangold may be preserved in a sound state till midsummer, if required, and even longer, with their feeding properties little impaired,—especially if the heap be turned over in spring, and any young shoots rubbed off, besides removing any decayed roots.

*Produce.*—The produce varies with the climate, soil, season, manuring, care bestowed on cultivation, &c. Where all these are favourable, over forty tons per acre have been obtained; but twenty to twenty-five tons may be considered as the average, and twenty-five to thirty tons may be reckoned a good crop.

The Mangold Wurzel is less variable in its produce than the turnip, not being so liable to casualties during its growth; the principal ones to which the former are liable, are the occurrence of occasional blanks owing to the failure of the seed in germinating, vitality having been destroyed, perhaps before sowing, or afterwards by some accident; but these will, indeed, be few, if care be taken in procuring genuine seed, sowing it in favourable weather, and not at too great a depth; if these blanks be filled up by transplanting, little loss will be sustained. Starting to seed is the greatest evil attending its cultivation, which, however, may be greatly checked by taking the precaution described in thinning. Any plant that may afterwards start should have the seed stalk within broken, or cut off, and this operation repeated, if necessary. By this means, those plants which would otherwise be worthless, may be made to produce tolerable bulbs.

*Most economical mode of Consumption.*—On all farms where the Mangold Wurzel is grown, there is a sufficiency of Swedes and other turnips raised for food for the cattle during the early part of winter, mangolds not being suited for early use, as they contain a peculiar acrid principle, when freshly taken out of the ground, which exercises an injurious effect on cattle, producing a very laxative state of the bowels, but which, in the course of a couple of months, either entirely disappears, or undergoes such a change as renders their use harmless; and cattle are thus found to thrive better on them when kept over till towards spring.

The best way, therefore, is to consume the Aberdeen and other soft turnips first, then the Swedes, which should at least hold out till January or February, when the Mangold will be ready for use. The change from the turnips to Mangold should be gradual, whether the animals be fattening, milking, or store cattle, in order to prevent the latter producing those laxative effects above alluded to. Hay or straw should be given to the cattle, between each feed of Mangolds. The bulbs may be sliced or pulped, but they are frequently given whole.

*Value as a Feeding Stuff.*—Every animal on the

farm has a great relish for Mangold Wurzel, and thrives remarkably well on it. They are excellent food for milch cows, producing a large flow of milk and not communicating any disagreeable flavour to it or the butter made from it. Steamed for pigs, they form, with the addition of a small portion of meal, valuable feeding. Horses also relish them, and small farmers, who cannot afford oats to their horses, may keep them in excellent condition during the winter and spring months fed on boiled mangolds mixed with a little bran or bruised oats, in addition to hay or oatstraw. About six stones of mangold, with intermediate feeds of hay or straw, is a fair day's allowance for an ordinary sized cow.

It appears to me desirable to give the following extracts from the opinions recorded on the value of Mangold as food for fattening cattle, milch cows, and other animals, by gentlemen distinguished by their practical and scientific attainments:—

“The Mangold is known to be good for all animals giving milk. But it also appears, from a remarkable experiment of Lord Spencer, that this root is good for fattening also. The two beasts put up by him made even more progress when fed alternately upon mangold than upon turnips, and he considers the result to be decisive.”—*Mr. Pusey (Journal of the Royal Agricultural Society of England, vol. III, p. 201).*

“All stock like it, even horses thrive upon it; it is cheap food, and may be given to cattle in autumn if chaff is but admixed with it to counteract its laxative effect.”—*Mr. Bond (Farmer's Magazine).*

“This root is a very valuable food for cattle, is much relished by them, fattens well, and gives a rich milk.”—*Professor Johnston (Highland Society's Journal, p. 607).*

“Its use is principally as food for milch cattle, for which it is superior to all other kinds of green crop, yet its culture has not extended by any means in proportion to its value.”—*Professor Murphy (Agricultural Instructor, p. 52).*

“Field-beet is the best of the root class of vegetables for a cow giving milk.”—*Martin Doyle.*

“My experience of the value of this root has been so long and so uniform that I have no hesitation in calling upon my brother farmers, who are similarly situated as to their climate and soil, to participate in its advantages.”—*Mr. Paget (Journal of the Royal Agricultural Society of England, vol. XVII, p. 408).*

“Experiments have been made to test the value of Mangold Wurzel compared with Swede turnips in the fattening of cattle. The experiments which have come under my knowledge—the estimate of the increase of weight of the animals experimented upon having been made from external measurement, and not in scales—do not appear to me to be decisive, but only indicative of considerable superiority in the fattening properties of Mangold Wurzel over the Swedes.”—*Mr. Colman (European Agriculture, p. 260).*

In the interesting experiments in fattening cattle on different descriptions of food, which were carried out on Colonel M'Douall's farm in Wigtonshire, and the results of which are recorded by him in the *Journal of the Royal Agricultural Society of England*, (Vol. XIII. Part I.) the valuable feeding properties of Mangold are clearly established, but in that climate and soil, as stated in a preceding part of this essay, a considerably larger acreable produce of Swedes can be obtained. The following note was appended by the late Mr. Pusey to Colonel M'Douall's observations on the relative merits of Mangolds and Swedes. “There is no doubt that in this part of England, (Berkshire for instance,) it is as easy to grow thirty tons of Mangold as it is to grow twenty tons of Swedes to the acre. Assuming Colonel M'Douall's results to be such as would ordinarily take place, the superior profits of

Mangolds over Swedes is very great, for the money returns will stand as follows:

Mangold, ... ..	£13 2 6	per acre.
Swedes, ... ..	6 5 0	"

The Money return from the Mangold therefore appears to be more than double that from the Swede. There is also the great advantage of the land being clear for the timely sowing of barley, by feeding stock on Mangold, which, of course, has been stored, instead of keeping the sheep on Swedes run to seed in April, while the seed time for barley is passing or gone. This experiment strongly confirms those of the late Lord Spencer, which appeared some years since in this Journal. The laxative tendency of Mangold is easily, as in this case counteracted by the accompaniment of bean meal."

Dr. Voelcker has recently drawn attention to the singular circumstance that although the Mangold is "justly esteemed on account of its fattening properties when given to beasts, yet it appears to be about the worst description of roots that can be given to sheep." And again he says, "On further inquiry I have learned that this observation is confirmed by many practical feeders. Mangolds, therefore, ought not to be given to sheep."

The following table shows the quantity of milk yielded by cows fed at the Albert Farm on mangolds, as compared with that given by the same cows when fed on Swedish turnips. The turnips and mangolds were prepared in the same manner (washed and sliced), and in both instances the cattle were out for water and exercise an hour daily; and their treatment in every other respect was precisely similar:—

Date.	No of Cows milked.	Quantity of food consumed by each cow daily.	Quantity of milk yielded	Total.	Increase.	Daily Increase.
1858.						
Feb. 15.	23	6½ st Swedish Turnips, Oat Straw, <i>ad libitum</i> .	28½			
" 16.	23	Do. Do.	29			
" 26.	23	6½ st Mangolds, Oat Straw, <i>ad libitum</i> .	31	57½		
" 27.	23	Do. Do.	32	63		
					5½	2½

The change of food from Swedes to mangold took place on the 17th, and with the view of preventing the secretion of milk, either as regards quantity or quality, being influenced by the former mode of feeding, the second experiment was not made until the 26th. As fully three-fourths of the cows were heavy in calf, and the quantity of milk yielded by them naturally on the decrease, the period which elapsed between the trials on the 15th and 16th and those on the 26th and 27th would, to some extent, lessen the result in favour of the mangolds.

The annexed table gives the results of an experiment recently made at the Albert Farm, by churning some of the whole milk yielded by the cows when fed on mangolds and oat straw:—

Quantity of milk churned	Butter produced.	Cream yielded	Quantity of cream to produce 1 lb Butter.	Quantity of milk to produce 1 quart Cream.	Butter produced by 1 qt. Cream.	Quantity of milk to produce 1 lb. Butter.
Quarts.	lbs. ozs.	Quarts.	Quarts.	Quarts.	ozs.	Quarts.
40	4 1½	4 2-5	1 1-15	9 1-11	15	10 (nearly.)

*Composition of Mangold Wurzel.*—Dr. Voelcker, in his very valuable and recently published work,

\* "On the Chemistry of Food," p. 30.

+ The Lactometer indicated 11 per cent. of cream.

"*The Chemistry of Food*," (p. 28,) so have been analysed by Professors Wolff, and myself; but as it will be utility to mention these various analyses shall leave them unnoticed, and state the composition of good mangold which has been calculated from 13 published roots:—

	In No. 100
Water, .. ..	87
Flesh-forming Constituents, ..	1
Woody Fibre, .. ..	1
Sugar, .. ..	6
Pectin, Gum, &c. .. ..	5
Inorganic matters (ash) .. ..	0
	100

"Mangolds, it will be observed, contain as much water and dry matters on the whole, are almost as nutritious if they are given to fattening beasts months keeping. . . . The value of stored mangolds, when compared with fresh root, may be due to the absence of principle in old roots, but doubtless is due also to the larger amount of sugar mangolds contain. An examination of mangolds, has shown me that, on keeping in the fresh roots is gradually forming which appears to be more conducive to fattening of beasts than pectin. For mangold wurzel ought not to be supplied before the latter end of December or of January."

According to the analyses of Professor Mr. Ogston, of Long Red and Yellow mangolds gave the following results (in 100

	Long Red	
	Bulb.	Leaf.
Potash, .. ..	29-08	27-
Soda, .. ..	19-05	5-
Lime, .. ..	2-17	9-
Magnesia, .. ..	2-79	3-
Peroxide of Iron, .. ..	0-56	0-
Silica, .. ..	4-11	1-
Sulphuric Acid, .. ..	3-31	6-
Phosphoric Acid, .. ..	3-11	4-
Carbonic Acid, .. ..	21-61	6-
Chloride of Sodium (com. Salt)	14-18	29-
Total, .. ..	99-94	99-
Per centage of Ash, .. ..	1-60	1-

It may be observed by an inspection of the foregoing table, that the tops or leaves contain phosphoric acid, lime, and magnesia, but contain less of the alkaline carbonates of potash, soda, &c. It will be seen that both tops and bulbs contain a large amount of common salt, which accounts for the results arising from its application to

Professor Johnston says, "the dry mangold wurzel and the carrot resemble in their composition that of the turnip. Some of the roots contain still more sugar. They contain the turnip in their percentage of dry matter. This in the three roots, is nearly as follows:

	Turnip.	Mangold.
Dry nutritive matter, 8 to 12	1	1
Water, ... ..	92 to 88	8

Hence the generally more nutritious two latter roots, weight for weight. *Agricultural Chemistry*, p. 326.)































































































